

brushing is insufficient to produce sound, still they may move the charcoal sufficiently to produce alternations of current, each of which may be able to set up vibrations in the telephone plate in its own period, or a modification of it, giving what I call the jarring sound. If, therefore, we have this sound, we know that either the microphone is exposed to sounds so loud as to produce complete break of contact, or that there is a motion going on affecting it, of insufficient rapidity to be audible.

With the object of reproducing the voice or musical notes, I have made the following modification of the instrument:—A ferrotype plate 3 inches in diameter is fastened over a hole $2\frac{1}{2}$ inches in diameter in a thick piece of wood; a flat piece of gas carbon weighing a few grains and having a fine copper wire attached to it is fastened to the top of the plate in the centre; over the piece of carbon is suspended by a wire spring another piece of carbon finely pointed, weighing about $\frac{1}{4}$ oz., and adjusted so as just to touch the carbon plate. The current is then led by the wires through the carbon point, and by careful adjustment of the latter almost any degree of sensitiveness can be attained. Whenever the sound becomes too loud the current is broken, and minute sparks are seen at the carbon point, and the jarring sound is heard at the same time in the telephone. The sound of a musical box is perfectly reproduced when the box is held in the air; the instrument is therefore sensible to sound-waves in air as in solids.

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I SEND an account of an experiment with the microphone which may interest some of your readers.

A microphone, made of three pieces of gas carbon (as described by Prof. Hughes) and the primary wire of a Du Bois Reymond's induction-coil, are placed in the circuit of a single Daniell cell. The wires from the secondary coil (pushed home) are attached to the poles of a Lippmann's capillary electrometer. The Daniell and microphone are twenty-five feet distant from the electrometer. If an observer watches the capillary-tube and speaks or sings to the microphone (*which is twenty-five feet distant*) definite and large movements of the mercury-column will be seen. The movements for various letters resemble those which have been previously observed to take place with the telephone, the "w" giving its curious double movement.

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EARTHQUAKE IN VENEZUELA

IN the evening of the 12th of this month a severe earthquake destroyed the town of Cua, in this country. Cua is situated on the left bank of the River Tuy, in $10^{\circ} 8' 15''$ L. N. and $66^{\circ} 55' W.$, Greenw. The height over the level of the Caribbean Sea I found in 1873, by barometrical measurement, 232 metres. It was the centre of a very flourishing agricultural district (annual produce, about 80,000*l.* a year), and had about 3,000 inhabitants.

The weather had been for weeks exceedingly hot, as generally this year in Venezuela. At 5 o'clock in the afternoon, before the earthquake, a temperature of 100° is said to have been noticed, and six days later, at the same hour, I observed myself 95° . The sky was clear, and the moon in perfect brightness. The shock occurred some minutes before a quarter to nine o'clock, and so violent was it that in less than two seconds all the centre of the town was a heap of ruins. It is impossible to fix the exact time of the shock, but it was felt in Carácas at 8h. 41m. 34s., the distance in a straight line between both places being about twenty-six English miles.

The centre of the town was situated on a small hill, about 20 metres over the lower part. The hill is com-

posed of gneiss, micaceous and chloritic schists, rising rather steep towards W.S.W. This hill is surrounded by strata of clay and marl, covered by a deep stratum of alluvial soil, and resting on dark limestone and argillaceous schists, containing numerous crystals of iron pyrites.

Only the upper town was laid waste; the lower part suffered comparatively very little. From actual observations I found that the angle of emergence of the shock was about 60° . The centre cannot have been very deep, as the destruction was limited to a spot measuring only one square mile, although the shock of the transverse wave was felt in places 100 miles distant. The soil had burst at different places, giving issue to water highly impregnated with sulphuretted hydrogen. The shocks continued for several days, and are not yet entirely gone, but no further damage has been caused. About 300 people were killed; the loss of property is said to be about 300,000*l.* sterling.

I have reason to think that this earthquake had nothing to do with volcanic forces, but was due to an interior subsidence or downfall of calcareous rock, as I intend to prove in a special memoir on this subject, as soon as I shall have visited the locality once more.

Carácas, April 30

A. ERNST

OUR ASTRONOMICAL COLUMN

TEMPEL'S COMET, 1873, II.—We continue the epheemeris of this comet, for the latter half of June, as given by M. Schulhof in the Paris *Bulletin International* of May 7. If the calculated epoch of perihelion passage be approximately correct, the intensity of light will be increasing, and the comet would arrive at its least distance from the earth early in July. But the possible error in the mean motion determined from the observations of 1873, may render a search over a wide extent of sky unavoidable, if the comet is to be recovered at the present return. Shortly before the completion of his calculations M. Schulhof informed the writer that the probable error in the mean daily motion would not exceed $\pm 7''$, but this degree of uncertainty involves a difference of nearly ± 20 days in the date of perihelion passage, so that the comet may be found after close search in a position considerably distant from the computed one. As in other similar cases, if the observer has the command of an equatorially-mounted instrument of good aperture, the most promising plan of search will be to commence at the calculated declination for the day, extending the sweep to 30m. or 40m. on each side of the calculated R.A., and to continue the same proceeding for 3° or 4° on each side of the calculated declination. It may be remarked that the computed R.A. for a certain change in perihelion passage, varies more rapidly than the computed declination. Perhaps there is a greater probability of the comet being detected at the latter end of June than subsequently, if the weather is generally favourable for a careful search.

The following positions for Paris midnight are deduced on the assumption that the comet will arrive at perihelion Sept. 1st, the most probable date:—

		Right Ascension.		N. Declina- tion.	Distance from earth.	Intensity of light.
		h. m. s.				
June	15	... 15 34 44	...	5 6	... 0.667	... 0.90
"	19	... 15 32 15	...	4 17	... 0.659	... 0.95
"	23	... 15 30 20	...	3 20	... 0.654	... 0.99
"	27	... 15 29 5	...	2 15	... 0.651	... 1.03
July	1	... 15 28 31	...	1 1	... 0.649	... 1.06

THE RECENT TRANSIT OF MERCURY.—In the instructions for observing this phenomenon suggested by Prof. Newcomb, and circulated by the United States Naval Observatory, it is remarked that "its accurate observation is of especial importance as affording data

which will be decisive of the question whether the result of Leverrier, that the motion of the perihelion of Mercury is much greater than that due to the action of the known planets, is really correct." So far as the results of observation have been made known, there is every indication that the theory of Leverrier will receive a striking confirmation therefrom. The observations of first internal contact in Europe are closely accordant with calculation; and in a telegram from M. André, in charge of the French expedition, despatched through the liberality of M. Bischoffsheim to Ogden, in the Utah territory, for the observation of the transit, it is stated—"sortie conforme théorie."

Adopting Leverrier's diameters of sun and planet, deduced from his elaborate discussion of the transits of Mercury observed to 1832, and the value of solar parallax determined by Professor Newcomb (8".848), we have the following equations for the reduction of observed times of first external and internal contacts to the centre of the earth:—

$$\begin{array}{l} \text{h. m. s.} \quad \text{s.} \quad \text{s.} \\ \text{First ext. cont.} \dots 3 \ 13 \ 10 + 74'53, \rho \sin l + 80'89, \rho \cos l \cos (L - 56'49'3) \\ \text{First int. cont.} \dots 3 \ 16 \ 8'4 + 74'92, \rho \sin l + 81'32, \rho \cos l \cos (L - 56'2'4) \end{array}$$

Where l is the geocentric latitude, which may be obtained together with ρ , the radius of earth at the point of observation, from Bessel's Tables in the *Berliner astronomisches Jahrbuch* for 1853, and L is the longitude from Greenwich counted towards the east: the resulting times are for Greenwich. We shall give next week a comparison between observation and calculation.

ENCKE'S COMET.—The *Fürstl. Jablonowski'schen Gesellschaft* of Leipzig have offered a prize in 1881 for a new investigation on the motion of this body, their former similar offer for 1877 not having met with a response. It is urged that the researches of Dr. von Asten, so far as they are known, have not led to any definite result, and other periodical comets not having shown any indications of a resisting action such as is apparent in the motion of Encke's comet, a further complete and separate investigation (*vollständige Neubearbeitung*) is much to be desired. Accordingly the Society's prize of 700 mark is again offered. It is stipulated that all known perturbing forces are to be taken into account, and the calculation is at least to include the period from 1848 to the last appearance of the comet. A similar work for the earlier portion of the interval elapsed since the first discovery in 1786, is reserved as the subject for a future prize.

In connection with the anomalous motion of Encke's comet it may be remarked that Brorsen's comet of short period appears deserving of much closer computation than it has yet received. After that of Encke's comet its perihelion distance is considerably less than in the case of any of the other comets forming this particular group, as the following statement will show. Biela's and De Vico's comets are omitted:—

Perihelion Distance of Encke's Comet	...	...	0.333
" " Brorsen's	...	...	0.595
" " Winnecke's	...	...	0.781
" " D'Arrest's	...	...	1.280
" " Tempel's (1873, II.)	...	...	1.339
" " Faye's	...	...	1.687
" " Tempel's 1867, II.)	...	...	1.769

GEOGRAPHICAL NOTES

THE Anniversary Meeting of the Geographical Society on Monday was not marked by any unusual feature. The address of the president—his retiring one, as it turns out—consisted as usual of a comprehensive review of the geographical work of the past year, an unusually eventful one in exploration. The Society is as prosperous as ever in members and money. There were on April 30 3,334 Fellows on the register, of whom no less than 762 are life members. On the motion of Sir Henry Rawlinson, the meeting adopted an alteration of the rule regu-

lating admission to meetings of exceptional interest, with a view to obviate certain difficulties which have arisen in this respect. The Royal Medals, the award of which we have already announced, were presented to Count Münster, the German ambassador, on behalf of Baron F. von Richthofen, the President of the German Geographical Society, and to Capt. H. Trotter, R.E., personally. The schools' prize medals were also presented to the successful competitors whose names we have before recorded. From the new president, Lord Dufferin, we may next year expect an address marked by unusual raciness, eloquence, and intelligence; Lord Dufferin will probably return to this country in autumn.

THE Committee of the African Exploration Fund of the Royal Geographical Society have at length definitely resolved to despatch a carefully organised expedition to explore the unknown tract of country lying between the caravan road which, as we have before mentioned, is being constructed from Dar-es-Salaam (a few miles south of Zanzibar), to the northern end of Lake Nyassa. Mr. Keith Johnston will, we believe, be in command, and will be accompanied by another European not yet selected. Should this expedition prove successful, and, what is equally important, sufficient funds be forthcoming, the committee contemplate pushing their explorations to the southern end of Lake Tanganyika, a further distance of 190 miles, thus completing approximately two of the routes sketched out in the circular issued last summer. In order to enable the committee to despatch this expedition, which is expected to furnish important and valuable geographical information, the Council of the Geographical Society have just made a further grant of 500*l.* to the fund, and it is hoped that the public and the subscribers will lend it such additional support as will be required to carry out the objects in view.

AT the last meeting of the Geographical Society of Paris M. de Lesseps stated that Col. Gordon had pushed the Egyptian advanced posts up to the equator, and that now any traveller can go from Paris to the equator within sixty days if he has procured a letter of introduction from M. de Lesseps. Abbé Debaize, who, as we have already stated, intends to cross Africa, has availed himself of this privilege and is probably now on the banks of the Albert Nyanza. M. de Lesseps states, moreover, that the number of lakes is greater than was supposed after Stanley's mission, and Col. Gordon is making a careful survey of the newly Egyptianised country. He has sent to M. Daubrée, Director of the School of Mines, some specimens of gold and silver ores brought from the interior, in order to ascertain their value. The Society has recently received a detailed account of the expedition made by MM. Cambier and Marno from Zanzibar during the past winter. The journey lasted seven weeks, and was accomplished without loss of life. The chief object of this tour was to test the availability of the route by Mpwapwa for expeditions into the interior of Equatorial Africa. It was found to be well adapted even for waggons.

THE Italian Consul at Aden, who is now in Europe, is occupied with the formation of a society for the purpose of acquiring a portion of land and forming an Italian colony at Shoa. The object of the colony is to establish commercial relations between Italy and Central Africa. The African traveller, Carlo Piaggia, is now making the final preparations for a new journey to Equatorial Africa. This journey will be his fourth; formerly he has principally visited Abyssinia and Soudan.

MR. GORDON BENNETT's polar expedition, to which we have already referred, is not to start, it would seem, till 1879, when, in June, it will probably leave San Francisco for the route by Behring's Straits. The *Pandora*, which will be re-christened the *Jeannette*, is being thoroughly refitted in Walker's yards on the Thames.